

Mean-field and fluctuations for hub dynamics in heterogeneous random networks

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We consider heterogeneous random networks, where the network degree distribution follows a power-law, and each node dynamics is a random dynamical system, interacting with neighboring nodes via a random coupling function. We characterize the hub behavior by the mean-field, subject to statistically controlled fluctuations. In particular, we prove that the fluctuations are small over exponentially long time scales. Our results provide an explanation for several numerical observations, namely, a scaling relation between system size and frequency of large fluctuations, system size induced desynchronization, and Gaussian behavior of the fluctuations. This is joint work [Commun. Math. Phys. 406 (2025), 170] with Zheng Bian and Tiago Pereira (USP).